THE EFFECTS OF ONLINE METACOGNITIVE INSTRUCTION ON MANAGING STUDENT EXPECTATIONS

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Abstract
Students arrive at university with high expectations and consequently become dissatisfied when actual outcomes (i.e., grade or classification) do not correspond with their expectations. This can lead to disappointment and increased attrition rates. Several complex issues affect such behaviour and an obvious starting point is to understand how to help students manage their expectations. In this study, students were encouraged to develop their metacognitive awareness through structured critical reflective practice and other metacognitive activities to enable them to make more realistic predictions. In part fulfilment of their coursework, participants undertook the activities, which were neither assessed nor monitored (to encourage disclosure). At the outset participants completed an inventory to measure self-reported metacognitive awareness and were asked to predict the submission time and grade for their next assessment. Metacognitive training materials were uploaded weekly for duration of the 6-week study period. In addition, each week, participants critically reflected using a structured reflection sheet situated on the University’s VLE. At the end of the period, the inventories were again administered. Baseline scores from the inventories were compared with post study scores, content analysis was conducted on the reflections and students’ predicted dates and grades were compared with actual dates and grades. Many participants dropped-out over the study period, however scores on the metacognitive awareness inventory increased significantly following the intervention, but no apparent increase in metacognition was apparent in the reflective spreadsheets. Negative, weak, non-significant relationships were found between metacognitive awareness prior to the intervention and accuracy of predicted outcomes for both submission time and grade. Further work needs to address how to engage and encourage all students, but especially those low in metacognition, to develop as critical reflective practitioners which would enhance metacognitive skills. Ultimately, better metacognition should lead to improved self-judgement and the ability to make more realistic predictions. In turn this could lead to greater satisfaction and more realistic expectations.

Keywords: metacognition, prediction, reflective practice, experimentation

1 INTRODUCTION
Humans use heuristics to reduce the difficulty of processing mental tasks [1] such as making predictions. However, in some circumstances, heuristics can lead to persistent biases with serious implications. People have high confidence for predictions based on heuristics [2] and ‘overconfidence can cause the strategic planner to overlook or misjudge pathways to disaster’ [3, p. 133]. Evidence suggests that predictions are frequently incorrect and that predicted and actual outcomes differ significantly [4]. Reasons for these misjudgements include, but are not restricted to, hindsight bias [5], judgements of correlation and causality [6], representativeness [7], overconfidence and a desire for certainty [8], a lack of information to provide accurate assessments, a lack of consideration of what is unknown and neglect of available, relevant and useful information. These misperceptions often lead to inaccurate estimates typically biased towards overestimation of ability, skills and knowledge.

Taking a course at a UK Higher Education Institution (HEI) is costly in terms of effort, time and money. Students expect the benefits to outweigh the costs in order to derive satisfaction [9]. Satisfaction ratings can affect the reputation of an HEI, tutor evaluations [10] as well as attrition rates. The level at which satisfaction is rated is determined by students’ expectations (e.g., [10, 11]). Given the likelihood of cognitive biases, it is not surprising that student expectations are frequently unrealistic. However, rather than focus on helping students to develop more realistic expectations, staff at HEIs are typically encouraged to provide environments that enhance the student experience and surpass student expectations (e.g., [9]).
Investigation of unrealistic student expectations is not new. For example, [10] found that even when college students expressed 100% certainty in the accuracy of their answers to general knowledge questions, they were wrong 20% of the time. Mabe and West [12] found weak correlation (0.29) in their meta-analysis of studies explaining the relationship between self-perceptions of knowledge and objective performance. Buehler, Griffin and Ross [13] reported that when judging quantities, participants expected a 2% error rate, but the real error rate was 46%. Moreover, even when warned about over-confidence (bias), these participants were still overconfident. Buehler and colleagues [13] asked students to estimate when they thought it was 50%, 75%, and 99% probable their personal projects would be completed. Only about 30% of the students completed their projects in the amount of time they predicted. More recently, first year college students' ratings of their academic skill were found to correlate only 0.35 with their instructors' ratings [14]. Overestimates of ability are related to underestimates of time taken to complete a task. Buehler et al. [13] found college students took 3 weeks longer than their most realistic estimate to complete their final project and even one week longer than their worst case scenario. They termed this 'the planning fallacy'. Later, Buehler, Griffin and MacDonald [15] asked students to predict when they would complete a project and how confident they were about this prediction. Only 45% of those who were 99% confident finished the project within the time they estimated. Dunning and coworkers [16] found that many college students whose scores were actually in the lowest quartile on a course exam, considered that they outperformed a majority of their peers. Dunning and coworkers [4] claimed that incompetent individuals suffer a 'double curse': their deficits not only cause them to make errors, they also prevent them from gaining insight into their errors. Furthermore, compared with good students, poor students less successfully identify which specific questions they have answered correctly [17]. Thiede, Anderson and Therriault (2003, cited in [4]) suggest students make more effective decisions about where to apply their learning efforts when they can accurately discern their strengths and weaknesses. Accurate self-assessments allow students to become more autonomous agents in their education, taking responsibility for gaining and improving on their knowledge and skills [18;19]. Self assessment requires metacognition [20].

Metacognition refers to knowledge about, awareness and control of one's cognitive processes [20]; thinking about thinking; knowing about knowing [21]. Metacognition is a predictor of successful learning and academic performance [16;22] and intelligence [24]. Although a precise definition of metacognition is elusive, it is generally understood to include the skills of planning, monitoring and evaluation with a consistent emphasis on overseeing and regulating cognitive processes [25]. Metacognition can be assessed using self-report measures such as the Metacognitive Awareness Inventory [26] and through content analysis such as that derived by Hatton and Smith [27]. Individuals assessed with a high metacognitive knowledge and skills are able to adapt to ensure goal attainment. These skills may be refined through reflective practice (e.g., [28; 29]).

Students in Higher Education (HE) are increasingly required to develop personally and professionally by reflecting critically on their learning as part of their coursework. However, there exist difficulties with teaching and encouraging reflective practice as students and even some staff are uncomfortable with the concept [30]. In addition, the current assessment-driven paradigm in HE results in reflections being assessed as course-work. This is potentially problematic as when reflections are read, graded or assessed by others, the incentive is to demonstrate knowledge and hide ignorance or doubt [31; 32; 33]. This is counter to Dewey's [29] original purpose of reflection in which learning is derived from making mistakes and solving problems.

Reflective practice is typically a paper and pen exercise (logs and journals) requiring creative and deep thinking. The inherent nebulous nature and lack of instruction makes effective reflective practice difficult for many. Furthermore, perhaps in part due to membership of the 'net generation' [34], some students might not engage in the reflective process since it does not align with their preferred learning style [35]. This is exaggerated when reflective practice is a paper and pen process and might be reduced when it is undertaken via information and communication technology (ICT). Greater honesty and disclosure in ICT-mediated communication has been found in an organisational context [36]. ICT can afford advantages over pen and paper approaches such as accessibility, synchronous and asynchronous communication, a 'safe space' for interactions and personal thoughts, and importantly, anytime, anyplace learning [37;38]. In addition, ICT can facilitate reflective thinking [37;39] and furthermore, as it is an inherent part of the 'net generation' [34], it appeals to this population’s learning style [35]. However, without appropriate structure and confidentiality, ICT used for reflective practice can retain some of the disadvantageous characteristics of traditional reflective approaches in which the potential for maximizing metacognition and learning is not achieved. Structured instruction has been found to enhance metacognition, thus learning. For example, when [39] investigated the use of
'intelligent' instructional software, a 'Cognitive Tutor', to guide participants in problem solving tasks by means of structuring (scaffolding), they found enhanced metacognition.

In order to encourage HE students' effective critical reflective practice, Mair [40] developed a spreadsheet situated on the University's virtual learning environment (VLE), incorporating prompts for guidance and assuring confidentiality. The aim was to simplify and structure the recording, storage and retrieval of reflections. In addition, disclosure of weakness was encouraged as students were assured the reflective content would be neither monitored nor assessed, but existed for them to reflect critically on their learning. Thus, students were encouraged to focus on learning about learning, as opposed to learning about content. Findings demonstrated a deeper understanding of reflective practice and enhanced metacognition following the six-week study.

In sum, humans are poor predictors. Many students arrive at university with unrealistically high expectations which lead to disappointment and disengagement. Several complex issues affect such behaviour and an obvious starting point is to understand how to help students have more realistic expectations. Thiede et al. (2003, cited in [4]) suggest students are more strategic when they have increased metacognitive awareness. Metacognition has been correlated with academic success (e.g., [16;22]). A moderate correlation (.41) between self-confidence and metacognition has been noted [42]. Unsurprisingly, they found that confidence is involved in accurate (correct) performance. However they argue that confidence is also involved in certainty of beliefs about events that may never occur. Without doubt, the relationships among metacognition, academic performance and confidence are interesting; increasing the former two factors is desirable, moderating the latter is necessary, as over-confidence can lead to unrealistic expectations. Thus in HE, dissatisfaction can result from unrealistic predictions which do not correspond with expectations.

2 METHOD

In order to address the issues described above, underlying, executive cognitive strategies were developed by means of metacognitive instruction and structured critical reflection using ICT. The role and interaction of metacognitive instruction with confidence in expectations was investigated. It was predicted that metacognitive awareness would increase following a 6-week metacognitive instruction programme and that those students who completed the programme would make more accurate predictions of time of completion and awarded grade for a piece of coursework.

2.1 Methodology

2.1.1 Participants

Fifty-four undergraduate students participated in this study in part fulfilment of their coursework. Fully informed consent for the analysis of resultant data was given in advance.

2.1.2 Materials

The Metacognitive Awareness Inventory [26] was used to measure self-reported metacognitive awareness. The MAI is 52-item Metacognitive Awareness Inventory (MAI) measures a range of aspects of metacognition such as monitoring, planning, comprehension using a 7-point Likert scale. In this study the MAI was adapted to a 6 point scale as in [33]. Reading [21:42;43:44;45;46] and questionnaire materials (i-iv and vi) adapted from [47], and (v) adapted from [48] were selected for their metacognitive content. The materials were: (i) Self-evaluation on reflective practice (p. 172); (ii) Evidence of competence in learning (pp. 290-291); (iii) Evidence of competence in learning from my own mistakes (pp. 284-285); (iv) Evidence of competence in working independently (pp. 258-259); (v) Goal Variables Activity (pp. 1061-1070) ; and (vi) Evidence of improvements in learning since starting this study (pp. 290-291).

2.1.3 Procedure

The participants were instructed on using the online structured spreadsheet for reflection and were then randomly allocated to either the Reading Group (Group 1), which completed a reading activity each week, or Activity Group (Group 2), which completed a questionnaire type activity each week. Participants were informed that the instructional and reflection activities would be neither assessed nor monitored. At the outset, all participants completed the MAI [26] to measure self-reported metacognitive awareness and were asked to predict the time and date they would submit their next assessment as well as the grade they would be awarded for it.
The online structured spreadsheet was situated on a dedicated site on the University’s virtual learning environment (VLE). The reading and questionnaire materials were uploaded to the site weekly for the 6-week study period. In addition, each week, participants critically reflected using the online structured reflection sheet [33;44;45]. At the end of the 6-week period, the MAI was re-administered. Baseline and post-study scores from the MAI were compared, content analysis was conducted on the reflections and students’ predicted dates and grades were compared with actual dates and grades.

3 RESULTS

It was predicted that metacognitive awareness would increase following a 6-week metacognitive instruction programme and that those students who completed the programme would make more accurate predictions of time of completion and awarded grade for a piece of coursework.

3.1 Measures and analysis

MAI scores pre to post were compared between and within groups using 2-way t-tests. Participants’ predictions of submission times and grades were compared with actual submission times and grades. Reflective content recorded on the online spreadsheets was content-analysed using the four categories [27] to examine the depth and type of reflection; (1) descriptive: relating to a report of an event with no reasoning behind it; (2) descriptive reflection: reasons for an event based on personal judgement however they are written in a reported format; (3) dialogic: displaying a deeper level of personal thought, often showing exploration of alternatives; and (4) critical: descriptive and including socio-political contexts, reasons, relationships in which the event happened and the decisions that were made.

3.1.1 Metacognitive Awareness Inventory (MAI)

Fifty-four participants submitted the pre study MAI, however only 10 submitted the post-study MAI. Therefore results for the two experimental groups have been collapsed into one group (n=10). The MAI mean total pre score = 209.3 (52 items on a 6 point Likert scale); mean item score = 4.03. The MAI mean total post score = 221.91; mean item score = 4.27. A two-tailed t-test was conducted (p = 0.04).

3.1.2 Content analysis of reflection spreadsheets

Hatton and Smith’s [27] categories were used to analyse the content of the reflection spreadsheets (see Fig. 1).

3.1.3 Prediction accuracy

Participants were asked to predict the time they would submit a piece of coursework and the mark they would be awarded for it. Three participants made accurate predictions, 6 were under-confident (by between 2 and 22 marks) and only 1 was over-confident (5 marks) regarding the mark they would be awarded. Three participants over-estimated (by between 3.25 – 13.75 hours) the time it would take
to submit the assignment (i.e., they were under-confident). The other 7 participants predicted they would submit (by between 16.25 and 36 hours) before they actually did (i.e., they were over-confident). Fig. 2 shows the differences in predicted and actual marks and submission times for each participant (P). In order to establish if there was a relationship between metacognitive awareness (prior to the intervention) and prediction accuracy, a Spearman’s Rho correlation was conducted (this statistic was used because the data were not normally distributed). Non significant negative correlations were found between the pre-study MAI scores and the difference between the predicted and actual grade ($r = 0.41$), and between the predicted and actual submission time ($r = 0.46$) (Figures 3a and 3b).

These results, the study’s limitations and issues for further work are discussed below.
4 DISCUSSION

Much research, directed towards managing student expectations (e.g., [12;10;11]) has resulted in staff at HEIs being encouraged to enhance the student experience to surpass student expectations (e.g., [12]). However, evidence shows we are poor at making predictions [4;7] and therefore student expectations are typically unrealistic. Poor prediction of ability, and therefore outcomes, is common (e.g., [2;12;13;14;15;16;17]). However, increased metacognition, for example, the ability to discern strengths and weaknesses and to know when to apply specific strategies, can enable students to improve their knowledge and skills [18] make more effective decisions and ultimately, more realistic predictions. However, self assessment requires reflective practice [28;29], a component of metacognition (e.g., [20;21;25]) which is a predictor of successful learning and academic performance (e.g., [16;22]). Encouraging sustained, critical reflective practice can be problematic as students and even some staff are uncomfortable with the concept [30]; the consequences [31;32;33], and the process [34;35]. Information and communication technology (ICT) encourages greater honesty and disclosure, offers other advantages over pen and paper approaches [37;38], can facilitate reflective thinking [37;39;40;41]. Whilst enhanced metacognition is desirable, one outcome is increased confidence [34]. Although higher confidence can lead to better performance, it can also lead to unrealistic expectations [7]. In HE, over-confidence can result in dissatisfaction when the actual outcome (i.e. grade or classification) does not correspond with what was expected [4]. Thus although metacognition is indisputably valuable, the value lies in the application of metacognitive skills, rather than simply the acquisition of metacognitive knowledge.

Effective reflective practice is an applied metacognitive skill which develops the practitioner both personally and professionally, yet it is not typically used as a learning tool by students in HE. More often, reflective writing is a process of responding to predetermined questions, assessed as a stand-alone piece of work. Moreover, the questions frequently relate to what has been learned rather than how it has been learned. In the present study, participants were instructed to focus on how rather than what was learned and in order to encourage maximum disclosure, were informed that the content of their reflections and metacognitive activities would be neither monitored nor assessed.

Post-study scores on Metacognitive Awareness Inventory demonstrated a significant difference from pre-MAI scores ($p=0.04$). However, it is unclear what is indicated by the difference. For example students might provide lower scores after increasing metacognitive awareness through critical reflective practice, metacognitive exercises or both. In order to identify the direction of change, a qualitative analysis of reflection content was undertaken using Hatton and Smith’s categories for metacognition. However, findings from this content analysis demonstrated that participants’ metacognitive awareness, in terms of critical reflection, remained fairly level throughout. This could be because the ten participants who completed the study and submitted the reflection spreadsheets in week 6 had a high level of metacognition at the outset. Furthermore, it could be that the nature of the spreadsheet, designed to encourage and structure reflection, may indeed restrict it (please see Appendix A for an example of the headings on the reflection spreadsheet). Further amendments to the spreadsheet to address this issue are currently underway.

In order to ascertain if there was a relation ship between metacognition and prediction accuracy, scores from the MAI taken pre-intervention were correlated with the difference between predicted and actual submission time and predicted and actual grade. Non significant negative correlations were found between the pre-study MAI scores and the difference between the predicted and actual grade submission time i.e. it seems that participants with higher MAI scores were less likely to be over-confident, perhaps even under-confident. However, because of the small sample size, this correlation cannot be seen as indicative that there is no relationship. It remains to be seen if the predictions they made at the end of the study which realted to a second piece of coursework, were more accurate as a result of the present study.

This study has important limitations. Firstly, the meaning of the direction of change in MAI scores from baseline to post-study is unclear. The author is currently investigating the predictive outcomes of the MAI by comparing these with increased use of [27]'s category 4 in the reflection spreadsheets. In the present, the drop-out rate was amost 80% over the study period. Thus results of the study are limited by the small sample and also hampered by the sub-sample who completed the study as these participants possibly had greater metacognitive awareness at the start. Indeed, that the level of metacognition in the reflective content of the spreadsheets did not increase significantly throughout the study corroborates this suggestion. Following the study, participants were asked to predict submission time and grade for a following piece of work. It will be interesting to see if these predictions are more accurate for those who completed the present study compared with those who did not.
missing post-study questionnaires have since been returned. The resultant data is currently being analysed. Furthermore, those participants who dropped out of the study will be contacted and asked to participate in individual interviews in an attempt to ascertain why they discontinued and how they might be encouraged to participate in such activities in future.

5 CONCLUSION

In order to make realistic predictions, metacognitive skills, including deep self-awareness and monitoring, need to be developed. Students arrive at university with high expectations and consequently become dissatisfied when actual outcomes do not correspond with their expectations. The resulting disappointment can lead to a sense of injustice, the provision of poor feedback on staff and the HEI as well as increased attrition rates. Consequently, we need to understand how to help students manage their expectations. In the study reported here, structured critical reflective practice and other metacognitive activities were encouraged in order to help students make more realistic predictions. A significant change in metacognitive awareness was found after the study. However the meaning of the change is debatable. No significant relationships were found between metacognition and prediction accuracy. Further work is underway to extend the spreadsheet and to establish a reliable interpretation of MAI scores. In addition, the author is investigating how to engage and encourage all students, but especially those low in metacognition to develop as critical reflective practitioners which would enhance metacognitive skills. Ultimately, better metacognition should lead to more accurate self-judgement and thus the ability to make more realistic predictions. This would increase satisfaction as expectations would be in line with actual outcomes.

REFERENCES


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